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EXAMINER	
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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/834,816	O'CALLAGHAN, ANDRAIS	
	Examiner	Art Unit	
	Kevin Siangchin	2623	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-50* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *19-32* is/are allowed.

6)☒ Claim(s) *1-5,17,18,33-37,49 and 50* is/are rejected.

7)☒ Claim(s) *6-16 and 38-48* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Detailed Action

Specification

Objections

1. The specification is objected to because of the following informalities. On page 7, line 10 of the applicant's disclosure, "read, green, and blue" should be replaced with "red, green, and blue". Appropriate correction is required.

Claims

Objections

2. Claims 46 and 49 are objected to because of the following informalities. Claim 46 (page 23, line 12) and claim 49 (page 23, line 25) make reference to a boundary-adjusting *module* and an image-modifying *module*, respectively. It is clear that that the applicant intended to refer to a boundary-adjusting *step* in claim 46 and an image-modifying *step.* Appropriate correction is required.

Rejections Under U.S.C. § 112(2)

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 17, 31, and 49 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. *The following is in regard to Claim 17.* According to claim 17, the "image modifying module is further effective for changing the pixels of said digital image bordering said first image pixels to said common color and

having a common second brightness intensity lower than said first brightness intensity". However, according to claim 1, on which claim 17 depends, the "image modifying module [changes] the color of said first image pixels to a common predetermined color". By "changing the pixels of said digital image bordering said first image pixels to said common color", the bordering pixels would have the same color as the first image pixels. However, as stated in claim 17, the bordering pixels have "a common second brightness intensity lower than said first brightness intensity", which contradicts the previous statement by implying that the bordering pixels have a different color than the first image pixels. This difference arises because, strictly speaking, color is defined also by its brightness component (luminance). Similar arguments apply to claims 31 and 49.

6. For the remainder of this document, claim 17 will be interpreted as: The redeye reduction system of claim 1, wherein said predefined color has a first brightness intensity and a first chrominance, and wherein said image modifying module is further effective for changing the pixels of said digital image bordering said first image pixels to a second predefined color having the first chrominance and having a second brightness intensity lower than said first brightness intensity. Claims 31 and 49 will be interpreted similarly.

Rejections Under U.S.C. § 112(1)

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 17, 31, and 49 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. These claims indicate that image-modifying, according to the applicant's claimed invention, involves changing the pixels of said digital image bordering said first image pixels to a color having a common second brightness intensity lower than said first brightness intensity. However, according to the applicant's specification (e.g. page 10, lines 21-24), bordering pixels should be lighter (i.e. have a higher brightness intensity) than the pixels within pupil. For the remainder of this document, claims 17, 31, and 49 will be treated as if the

applicant intended the brightness intensity of the bordering pixels to be higher than that of the pixels within the pupil.

Rejections Under U.S.C. § 102(e)

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claim 1, 5, 33 and 37 are rejected under 35 U.S.C. 102(e) as being anticipated by Kinjo et al. (U.S. Patent 6,631,208).

11. *The following is in regard to Claim 33.* Kinjo et al. discloses an image processing method in which the effects of red-eye in a digitized image are corrected. This method comprises the following:

a. The step of sectioning a user designated region into areas on the basis of *characteristic amount* (Kinjo et al. Fig. 4, step 104). This step consists essentially of a thresholding operation that segments the user-designated region (henceforth, referred to as the redeye region) into separate regions (henceforth, referred to as segments). These regions are delineated according to the maxima of a three-dimensional *xyz* space (henceforth, referred to as the characteristic amount function) where the *z*-axis represents the image characteristic amounts for each pixel in the *xy*-plane representing the plane of the user-designated region. See Kinjo et al., column 4 lines 33-48, column 15 lines 28-39 and Figs. 10B-10C, for example. To represent the segments discretely, Kinjo et al. generates a matrix (e.g. Kinjo et al. Fig. 18), presumably having a one-to-one correspondence with the pixels of the user-designated region, where all elements that correspond to a segment are designated an *assigned number* unique to that segment (Kinjo et al., column 4

lines 40-47). For an exemplary discussion regarding this assigning process see columns 15-16 and Figs. 16B-17D.

The preceding relates to step (a) of the method, put forth in applicant's claim 33, in the following way. As mentioned, a matrix is generated by observing all the pixels in the redeye region and comparing a color-based parameter (i.e. the characteristic amount – the dependence of the characteristic amount on color is evident from Kinjo et al. equation (1) and the ensuing discussion in column 14, lines 50-67) to various thresholds (e.g. the dotted vertical lines in Kinjo et al. Fig. 10C) defined by the peaks of the characteristic amount functions. Notice, for instance, from Kinjo et al. Fig. 10C that two thresholds define a segment. The first threshold of this pair (i.e. the leftmost or lowest of the two – e.g. the first vertical dotted line in Kinjo et al. Fig. 10C) can be taken to be a *first* threshold. According to the aforementioned assigning process, pixels are given an assigned number depending on the segment to which they belong. For example, consider a segment delineated by a pair of thresholds. Pixels with characteristic amounts less than the first threshold are of a different segment and, therefore, given an assigned number (say, a *second* assigned number) different than the assigned number (say, the *first* assigned number) given to pixels that are greater than or equal to the first threshold – that is, pixels of the segment in question. These assigned numbers can be interpreted as logical values, in the sense that that they provide an arbitrary nomenclature for distinguishing, uniquely, one segment from another. The evaluation of whether a segment represents a red-pupil region is done on a per-segment basis. Therefore, during the evaluation of a segment, pixels having the assigned number attributed to that segment can be regarded as candidate pixels and all other pixels regarded as non-candidate pixels.

b. The step of identifying a plurality of cohesive pixels (i.e. segments) of candidate pixels for identifying a first target cohesive group among said plurality of cohesive groups. This segmentation step is encompassed by the thresholding process discussed above, relative to step (a). Kinjo et al. determines which among these segments have pixels with the highest color-based parameter (i.e. characteristic amount). Such a segment represents the redeye pupil region (i.e. a first target cohesive group) of the user-designated region. See, for example, the discussion in

Kinjo et al. column 5 lines 15-44, column 7 lines 8-17, column 17 lines 60-63 and column 18 lines 20-38.

c. The step of correcting (modifying) the pixels of the input digital image corresponding to the obtained red-eye pupil region (i.e. the image pixels corresponding to the first target cohesive group). Kinjo et al. suggest several approaches to this correction. One approach involves adjusting the lightness and saturation (thereby adjusting the color) of these pixels to a fixed level. See Kinjo et al. column 18 lines 45-63 and column 19 lines 1-9.

It has thus been shown that the image processing method of Kinjo et al. conforms to that which the applicant claims in claim 33. Therefore, the redeye reduction method proposed in applicant's claim 33 is anticipated by the teachings of Kinjo et al..

12. *The following is in regard to Claim 37.* As just shown, Kinjo et al. discloses a method of redeye reduction in accordance with claim 33. Furthermore, for each segment, in the image processing method of Kinjo et al., at least one of five *marks* is determined. These marks consist of a first mark indicating the roundness of the segment, a second mark indicating the position of the segment, a third mark indicating the surface area of the segment, a fourth mark for expressing the degree of poorness of color tone of the segment, and a fifth mark (the fifth mark is not relevant to this discussion). See, for example, Kinjo et al. column 5 lines 15-44. Note that the first through third marks, together, provide a measure of the size of the segment. Kinjo et al. suggests that the fourth mark can comprise at least one of an average value and maximum value of at lease one of the hue, saturation, and lightness (which together define the color of) the segment. See Kinjo et al. column 5 lines 15-44. In this way, the first through third marks represent a *size parameter*, similar to that of the applicant's claimed method, and the fourth mark can provide a *high parameter value* and an *average parameter value*, similar to those of the applicant's claimed method. Taking this into account, as well as the discussion above with regard to claim 33, it is thus shown that the image processing method of Kinjo et al. conforms to that which the applicant claims in claim 37. Therefore, the redeye reduction method proposed in applicant's claim 37 is anticipated by the teachings of Kinjo et al.

13. *The following is in regard to Claims 1 and 5.* These claims recite substantially the same limitations as claims 33 and 37, respectively. Therefore, with regard to claims 1 and 5, remarks analogous to those presented above relating to claims 33 and 37 are, respectively, applicable.

Rejections Under U.S.C. § 103(a)

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claims 1-4, 18, 33-36 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patti et al. ("Automatic Digital Redeye Reduction", IEEE 1998), in view of Acker et al. (U.S. Patent 6,009,209).

16. *The following is in regard to Claim 33.* Patti et al. disclose a redeye reduction method for reducing the effects of redeye in a digital image that includes at least one redeye region. This method comprises:

a. The step of generating a binary mask (matrix) for identifying candidate redeye pixels. See the section *Create Mask Algorithm* in Patti et al[1]. The algorithm to create this mask involves converting the pixels of the image to a non-standard luminance-chrominance representation (color-based parameter) and thresholding these converted pixels into candidate pixels and non-candidate pixels. Converted pixels having a value less than this threshold are assigned a logic value of zero ($b_{ij}^{(0)} = 0$), indicating that they are non-candidate pixels, and converted pixels having a value greater than or equal to this threshold are assigned a logic value of one ($b_{ij}^{(0)} = 1$), indicating that they are candidate pixels. See Patti et al. equation (2.2).

b. A segmentation step. Though Patti et al do not explicitly indicate this step, it should be apparent that the binary mask effectively segments the image into multiple groups of contiguous candidate

1 For convenience, the equations found on the second page of Patti et al. will be referred to as equations (2.1), (2.2) and (2.3), respectively.

pixels – i.e. cohesive segments (henceforth, referred to as segments). These groups are identified as isolated regions of the binary mask having $b_{ij}^{(0)} = 1$. See Patti et al. Figs. 2-4. Using the mask, the pupil (i.e. first target cohesive group/first redeye region) is then identified (second stage of flow diagram depicted in Patti et al. Fig. 2).

c. An image-modifying (correction) step. Since elements of the binary mask have a one-to-one correspondence with the converted image pixels (i.e. $b_{ij} \mapsto Cr_{ij}$), identification of the *image* pixels associated with the pupil follows trivially from identifying the pupil within the binary mask, as in step (b). The image-modifying step involves replacing these image pixels with pixels of a common predetermined color. See last paragraph of Section 4 of Patti et al.

Note, however, that Patti et al. does not show or suggest identifying the first target segment (i.e. pupil region), among the plurality of segments, as being the segment having the candidate pixel with the color-based parameter of highest value among all of said plurality of segments.

17. Acker et al. show, within the context of an automatic redeye removal/reduction method, that "automatic identification of the red eye region is based on characteristics common to all red eye artifacts – e.g., its shape tends to be compact and circular, with *high color saturation and a distinct brightness maxima*. These characteristics can be combined directly into a unified figure of merit that is optimized by searching for a roughly circular shape, surrounding the single point marked by the user, that maximizes these red eye characteristics" (Acker et al. column 6, lines 13-20). Thus, a region or segment of the image, having high color saturation and distinct brightness maxima, would be a likely candidate for the redeye (pupil) region. Such properties would correspond to a maximum in the aforementioned color-based parameter. This implies that searching for a segment or region of the image, which is preferably circular and maximizes color saturation and brightness (and, correspondingly, the color-based parameter), represents a viable method for locating or identifying the redeye (pupil) region.

18. It would be a relatively simple undertaking for one of ordinary skill in the art to incorporate this teaching into the method of Patti et al. by either identifying and/or locating the pupil region by searching for the segment or region of the image that maximizes the color-based parameter, in lieu of the algorithm for pupil location taught by

Patti et al., or by supplementing (say, by preceding) that algorithm with a search for the segment or region of the image that maximizes the color-based parameter. In either case, such a modification would represent an improvement over the method of Patti et al., in terms of efficiency, because the search space is effectively limited to the segments indicated by the binary mask, as opposed to an exhaustive search of the entire image plane. Given this advantage and the relative ease of such a modification, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to incorporate the teachings of Acker et al. into the method of Patti et al. by either identifying and/or locating the pupil region by searching for the segment or region of the image that maximizes the color-based parameter, in lieu of the algorithm for pupil location taught by Patti et al., or by supplementing (say, by preceding) that algorithm with a search for the segment or region of the image that maximizes the color-based parameter. In doing so, one would obtain a method of redeye reduction that satisfies all limitations of claim 33.

19. *The following is in regard to Claim 34-35.* As shown above, the teachings of Patti et al. can be combined with those of Acker et al. in such a way as to satisfy all the limitations of claim 33. The redeye reduction method of Patti et al. further includes the erosion of candidate segments. See Patti et al. equation (2.3). The erosion step refines the aforementioned binary mask and occurs between step (a) – i.e. creating a preliminary binary mask according to Patti et al. equation (2.2)) – step (b) - i.e. segmentation and pupil location. See the second column on page 2 of Patti et al. Patti et al. also perform this erosion twice. See the last paragraph on page 2 of Patti et al. Note that executing erosion according to equation (2.3) will erode pixels with less than two neighbors. It would have been obvious to one of ordinary skill in the art to initially erode pixels with less than three neighbors, as opposed to two, initially, since this would result in a more pronounced elimination of extraneous pixels around the edges of the candidate segments as well as small, spurious segments unlikely to represent the pupil. The number of neighbors in each iteration of the erosion and even the number of iterations are clearly parameters of Patti et al.'s redeye reduction method that can be readily adjusted depending on the effectiveness of the subsequent segmentation. In this way, the teachings of Patti et al. and Acker et al., when combined in the manner described above, can be easily modified to conform to claims 34-35.

20. *The following is in regard to Claim 36.* As shown above, the teachings of Patti et al. can be combined with those of Acker et al. in such a way as to satisfy all the limitations of claim 34. Again referring to Patti et al. equation (2.3), notice eroded pixels are set to 0, the second logic level. In this way, the teachings of Patti et al. and Acker et al. can be combined in such a way as to satisfy all limitations of claim 36.

21. *The following is in regard to Claim 50.* As shown above, the teachings of Patti et al. can be combined with those of Acker et al. in such a way as to satisfy all the limitations of claim 33. Patti et al.'s method of redeye reduction begins by transforming the 1/3 power of the input RGB image to an YCrCb representation and then defining a first threshold $T = Cr_{avg} + 0.2*(Cr_{max} - Cr_{min})$ for use in the subsequent thresholding operation (step (a) above). See the last paragraph on page 1 of Patti et al. and Patti et al. equation (2.1). Therefore, the teachings of Patti et al. and Acker et al., when combined in the manner described above, address all limitations of claim 50.

22. *The following is in regard to Claims 1-4 and 18.* These claims recite substantially the same limitations as claims 33-36 and 50, respectively. Therefore, with regard to claims 1-4 and 18, remarks analogous to those presented above relating to claims 33-36 and 50 are, respectively, applicable.

23. Claim 5 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patti et al., in view of Acker et al., as applied to claims 1 and 33 above, in further view of Kinjo et al..

24. *The following is in regard to Claim 37.* As shown above, the teachings of Patti et al. can be combined with those of Acker et al. in such a way as to satisfy all the limitations of claim 33. Patti et al. and Acker et al. do not teach a redeye reduction method wherein the component-connecting step (see the discussion above regarding claim 33) further includes generating statistical data for each of said plurality of cohesive groups including a high parameter value indicating the highest color-based parameter value of its corresponding candidate pixels, an average parameter value indicating the average color-based parameter value of its corresponding candidate pixels, and a size parameter value indicating its size.

25. Kinjo et al. discloses an image processing method for the reduction of redeye effects in a digital image. This image processing method includes a segmentation (component-connecting) step, wherein, for each segment, at least one of five *marks* is determined. These marks consist of a first mark indicating the roundness of the segment, a

second mark indicating the position of the segment, a third mark indicating the surface area of the segment, a fourth mark for expressing the degree of poorness of color tone of the segment, and a fifth mark (the fifth mark is not relevant to this discussion). See, for example, Kinjo et al. column 5 lines 15-44. Note that the first through third marks, together, provide a measure of the size of the segment. Kinjo et al. suggests that the fourth mark can comprise at least one of an average value and maximum value of at lease one of the hue, saturation, and lightness (which together define the color of) the segment. See Kinjo et al. column 5 lines 15-44. In this way, the first through third marks represent a *size parameter*, similar to that of the applicant's claimed method, and the fourth mark can provide a *high parameter value* and an *average parameter value*, similar to those of the applicant's claimed method.

26. Deriving such marks for the segments, determined by the component-connecting step of the redeye-reduction method obtained by combining the teachings of Patti et al. and Acker et al. in the manner discussed above, would be a simple undertaking for one of ordinary skill in the art, given the teachings of Kinjo et al. The information contained in these marks would provide an effective, alternative means to evaluate the size and shape of the segments obtained by the segmentation/component-connecting step of the redeye-reduction method obtained by combining the teachings of Patti et al. and Acker et al. This is an attractive alternative for locating the pupil region because using the marks of Kinjo et al., in the manner suggested by Kinjo et al., reduces the need for the exhaustive search scheme suggested by Patti et al. Similarly, the marks indicating the color properties of the segment can facilitate the search for pixels surrounding the periphery of the located pupil region, as taught by Patti et al. Given the facility of the information encompassed by Kinjo et al.'s marks and the relative ease of incorporating these marks into the method obtained by the combined teachings of Patti et al. and Acker et al., it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to derive marks, as taught by Kinjo et al., containing information regarding size, shape, location, maximum/minimum color, and average color, for each of the segments determined by the component-connecting/segmentation step of the method obtained by the combining the teachings of Patti et al. and Acker et al., in the manner discussed above. In doing so, one would obtain a method that conforms to the limitations put forth in claim 37.

27. *The following is in regard to Claims 5.* This claim recites substantially the same limitations as claim 37. Therefore, with regard to claim 5, remarks analogous to those presented above relating to claim 37 are applicable.

28. Claim 17 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Patti et al., in view of Acker et al., as applied to claims 1 and 33 above, in further view of Benati et al. (U.S. Patent 5,748,764).

29. *The following is in regard to Claim 49.* As shown above, the teachings of Patti et al. can be combined with those of Acker et al. in such a way as to satisfy all the limitations of claim 33. The image-modifying step (see discussion above relating to claim 33) of Patti et al.'s redeye reduction method involves replacing the color of pixels within the pupil region with a predetermined color having a first brightness intensity and having a first chrominance. See last paragraph of Section 4 in Patti et al. The image-modifying step, as taught by Patti et al., changes the color of the pixels bordering the pupil region to the same predetermined color as the pixels within the pupil region. Therefore, neither Acker et al. nor Patti et al. teach changing the pixels of the digital image bordering the pupil region to a common color having a second brightness intensity higher than said first brightness intensity.

30. Benati et al. disclose an automated method for the detection and correction of eye color defects due to flash illumination (with an emphasis on redeye effects). In Benati et al.'s method, border correction is performed on pixels neighboring at least one eye color defect pixel (i.e. a pixel in the pupil region). The colors of these neighboring pixels are changed so that they have the same chrominance as the pixels within the pupil region, but a higher luminance. See Benati et al. column 8, line 62-65 and column 9, lines 9-12. According to Benati et al. (Benati et al. column 2, lines 40-44), pixels on the border of the pupil region are corrected in this manner to create a more natural appearing correction.

31. Given the fact that the redeye reduction method, obtained by combining the teachings of Patti et al. and Acker et al. in the manner discussed above, identifies border pixels and attempts to correct them, it would be straightforward for one of ordinary skill in the art to simply modify this correction so that border pixels are treated in the manner suggested by Benati et al. According to Benati et al. (Benati et al. column 2, lines 40-44), pixels on the border of the pupil region are corrected in this manner to advantageously create a more natural appearing correction. Taking this into account, it would have been obvious to one of ordinary skill in the art, at the time of the applicant's claimed invention, to modify the image modifying/correction step of the redeye reduction method, obtained by combining the teachings of Patti et al. and Acker et al. in the manner discussed above, so that border pixels are

treated in the manner suggested by Benati et al. In doing so, one would obtain a redeye reduction method that conforms to the limitations of claim 49.

32. *The following is in regard to Claims 17.* This claim recites substantially the same limitations as claim 49. Therefore, with regard to claim 17, remarks analogous to those presented above relating to claim 49 are applicable.

Allowable Subject Matter

Objections, Allowable Subject Matter

33. Claims 6-16 and 38-48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

34. The following is a statement of reasons for the indication of allowable subject matter.

35. *The following is in regard to Claims 6 and 38.* Neither Patti et al., nor any of the prior art methods and systems encountered, performs a second target-determination according to these claims, in addition to the first target-determination. Specifically, prior art does not show searching for a regions, corresponding to a potential *second* pupil, having an average size and/or color that lies within a range dependant on the average size and/or color of the first pupil. It should be noted, however, that the effect of the pupil location algorithm in the method of Patti et al. is that segments having an average size that is not optimally correspondent to that of a pupil are filtered out. This, however, cannot be construed as fully satisfying the limitations of claims 6 or 38.

36. *The following is in regard to Claims 7-8 and 39-40.* As mentioned above, the encountered prior art failed to teach redeye reduction systems or methods that conform to the limitations of claim 6 or 38. However, it should be understood that the selection of the bounds of size and/or color parameter ranges that are dependant on the first pupil's size and/or color parameters can be made arbitrarily and, therefore, would have been obvious to one of ordinary skill in the art. Therefore, while the limitations of claims 7-8 and 39-40, relating to the numerical bounds of

these ranges, are, in and of themselves, not allowable, these claims are allowable by virtue of their dependence on their allowable claims 6 and 38, respectively.

37. *The following is in regard to Claims 9 and 41.* As mentioned above, the encountered prior art failed to teach redeye reduction systems or methods that conform to the limitations of claim 6 or 38. Patti et al., however, do locate the region corresponding to a pupil via a block matching algorithm that attempts to find the smallest s × s block in the input mask with the maximum number of white pixels (see Patti et al. equation (2)) – that is, the block with the highest boundary square population. Thus, pupil location is accomplished in essentially the same way as the applicant's second-target determination. In this way, the identification of the second target cohesive group, as proposed by the applicant, is not unique. However, the applicant's initial determination of the first pupil by searching for the segment with the highest color-content (e.g. saturation), and the subsequent usage (prior to the said determination of the boundary square population) of the size and/or color information of the found first pupil to eliminate segments within a specified range of the first pupil's color and/or size, is not shown in prior redeye reduction methods.

38. *The following is in regard to Claims 10 and 42.* As mentioned above, the encountered prior art failed to teach redeye reduction systems or methods that conform to the limitations of claim 9 or 41. Notice that claims 10 and 41 claim a modification of the second image pixels that is analogous to the modification of the first image pixels. . Therefore, while the limitations of claims 10 and 42, relating to the modification of the second image pixels, are, in and of themselves, not allowable, claims 10 and 42 are allowable by virtue of their dependence on their allowable claims 9 and 41, respectively.

39. *The following is in regard to Claims 11-14 and 43-46.* These claims are similar to claims 25-27. Please refer to the discussion below, with regard to claims 25-28, for the justification of allowing these claims.

40. *The following is in regard to Claims 15-16 and 47-48.* These claims are allowable for essentially the same reasons as claims 12-13 and 44-45, respectively. See the remarks above relating to those claims.

<u>Allowable Subject Matter</u>

41. Claims 19-32 are allowed.

42. The following is a statement of reasons for the indication of allowable subject matter. Note that the following does not address each allowable claim. For example, claims that are dependant on allowable claims, but contain subject matter that was shown above to be objectionable will not be treated here.

43. Generally speaking, the applicant's claimed system for redeye reduction represents a non-trivial, non-obvious modification or extension of the automated redeye reduction method disclosed by Patti et al. The similarities between the applicant's claimed methods and system with the redeye reduction method of Patti et al. should be evident from the foregoing discussion. For the sake of convenience and brevity, the first matrix generating module, component-connecting module, first target-determining module, second target-determination module, and image modifying module of claim 19, will be referred to as items (19.a)-(19.e), respectively

44. *The following is in regard to Claim 19.* It was shown above that the teachings of Patti et al. and Acker et al. can be combined so as to obtain a redeye reduction method or system wherein a first matrix is generated in accordance with (19.a), component-connection (segmentation) is performed in accordance with (19.b), and first target-determination is made in accordance with (19.c). Neither Patti et al., nor any of the prior art methods and systems encountered, performs a second target-determination according to (19.c), in addition to the first target-determination. Specifically, prior art does not show searching for a regions, corresponding to a potential *second* pupil, having an average size and/or color that lies within a range dependant on the average size and/or color of the first pupil. Nor does prior art show the selection of a region, satisfying this constraint, based on a calculated boundary square population[2]. It should be noted, however, that the effect of the pupil location algorithm in the method of Patti et al. is that segments having an average size that is not optimally correspondent to that of a pupil are filtered out. Furthermore, Patti et al. locates the region corresponding to a pupil via a block matching algorithm that attempts to find the smallest $s \times s$ block in the input mask with the maximum number of white pixels (see Patti et al. equation (2)) – that is, the block with the highest boundary square population. Thus, pupil location is accomplished in essentially the same way as the applicant's second-target determination. In this way, the

2 The term *boundary square population* was not encountered anywhere in the prior art. While the applicant sufficiently defines this value in the specification, the boundary square population label very poorly describes what this value actually represents (i.e. a measure of the pixel density within the smallest square in which a component fits, the higher the boundary square population value the denser the pixel population).

identification of the second target cohesive group, as proposed by the applicant, is not unique. However, the applicant's initial determination of the first pupil by searching for the segment with the highest color-content (e.g. saturation), and the subsequent usage (prior to the said determination of the boundary square population) of the size and/or color information of the found first pupil to eliminate segments within a specified range of the first pupil's color and/or size, is not shown in prior redeye reduction methods. Having found the first and, perhaps, the second pupil, it would be obvious to correct these regions in accordance with (19.e).

45. *The following is in regard to Claim 20-21.* As mentioned above, none of the encountered prior art utilizes the size and/or average color parameter ranges that are dependant on the located first pupil, as claimed in (19.d). It should be clear, however, that these ranges could be arbitrarily set to obtain the desired performance of the system or method.

46. *The following is in regard to Claim 25-27.* The redeye reduction method of Patti et al. includes a boundary adjustment step, subsequent to the segmentation and pupil location and preceding the image correction and color replacement, involving N dilations of the pupil region obtained by the aforementioned pupil location algorithm. See Section 4 of Patti et al., particularly the pseudo-code on page 5. The dilation is accomplished by inspecting pixels adjacent to pixels on the periphery of the pupil region and determining whether the color-based parameters η_{ij}^{r} and η_{ij}^{r-g} satisfy both of the following conditions

$$\eta_{ij}^{r} < TH_{r} \qquad (39.1)$$

$$\eta_{ij}^{r} < TH_{r-g} \qquad (39.2)$$

for preset thresholds, TH_r and TH_{r-g}. If the ij-th peripheral pixel satisfies both conditions (39.1) and (39.2) then that pixel is re-designated as belonging to the pupil region by setting the corresponding element $p_{ij}^{r} = 1$ in the binary mask. See last paragraph on page 4 of Patti et al. and the **if** clause in the pseudo-code on the last page of Patti et al. With some manipulation, conditions (39.1) and (39.2) can be expressed as a single condition involving the color-based parameter discussed above in relation to claims 1, 19, and 33 (i.e. Cr_{ij} – see column 1 on page 2 of Patti et al.). Such an expression can be shown to have the form $Cr_{ij} < T'$, where T' is a second threshold such that $T' < T$, T being the first threshold.

47. As mentioned, dilation is performed *N* times in Patti et al.'s method. Just as the thresholds in (39.1) and (39.2) can be arbitrarily set, so to can the threshold *T'*.

48. *The following is in regard to Claim 28.* While Patti et al. show the usage of dilation in a redeye reduction method, in a manner similar to the applicant, neither Patti et al.'s nor any of the encountered prior art redeye reduction methods include a means for generating a second mask obtained by thresholding with a threshold lower than the first and AND'ing this mask with the first dilated mask to obtain a final indication of the region corresponding to the first (and second) pupil(s). Logical AND, however, is a frequently used operation when dealing with and manipulating binary masks.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Siangchin whose telephone number is (703)305-7569. The examiner can normally be reached on 9:00am - 5:30pm, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703)308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Kevin Siangchin

Examiner
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